

## EGS CONFIDENCE TEST EXECUTION COVER SHEET

1. Test ID and Title: **ICT10 - EOC - FDF Interface Confidence Test**

2. Test Conductor / Test Lead Phil Parker

3. Planned Execution Date: 1/8/97

4. Actual Execution Date:  
**THIS TEST CAN'T BE SUPPORTED BY ECS RELEASE A**

5. Planned Configuration:

(Identify hardware elements and software release / version numbers to be used)

6. "As Run" Configuration:

7. Package items planned for execution:

(List test cases or steps planned for execution, e.g. ICT10.1, ICT10.2 steps 2-5, etc.)

8. Package items actually executed and deviations from currently published procedures.

9. Results

- a. Capabilities successfully demonstrated
- b. Capabilities not successfully demonstrated
- c. Requirements verified
- d. Discrepancy Reports submitted

## 10. Lessons Learned

## **ECS - FLIGHT DYNAMICS FACILITY INTERFACE CONFIDENCE TEST (ICT10)**

### **Test Objectives:**

The objective of this test is to verify that the ECS can receive required orbit, attitude and mission planning aid data for the AM-1 mission from the FDF and provide orbit and attitude telemetry subsets to FDF for refinement and anomaly investigation. FDF support for AM-1 and the EOC will be provided under a new operations concept that moves most FDF computations into the EOC on a set of FDF dedicated work-stations. The TDRSS On-board Navigation System (TONS) Ground Support System (TGSS) will also reside on the FDF workstations in the EOC. This concept is still being defined. Currently, the FDF will deliver 53 different products to the EOC via four different mechanisms:

- FTP transfer,
- LAN transfer between the FDF workstations and EOC elements supported by the features provided by the EOC in the Instrument Support Toolkit (IST),
- TONS Ground Support System (TGSS),
- Hard copy FAX

The EOC will provide 10 different data types to the FDF via three different mechanisms:

- FTP transfer,
- LAN transfer between the FDF workstations and EOC elements supported by the features provided by the EOC in the Instrument Support Toolkit (IST),
- Hard copy FAX

### **FDF - GSFC DAAC Interface**

**(TBS)**

The functions supported by this interface are:

- Real time attitude determination
- Non-real time attitude determination and attitude sensor calibration
- Mission Planning and Scheduling
- TDRSS On-board Navigation System (TONS) monitoring and support
- Maneuver Support

Requirements Verified:

EOC-5185#B

EOSD-1502#B

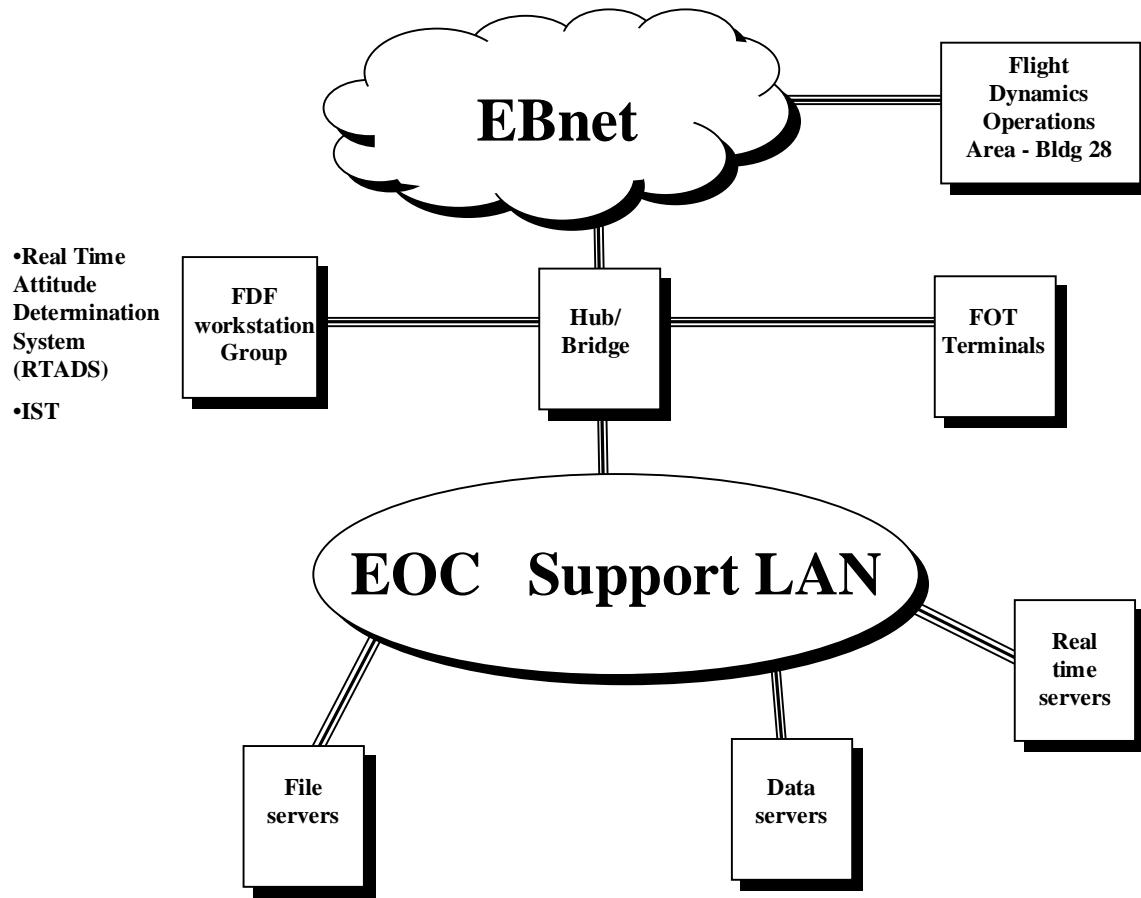
EOSD-1505#B

EOSD-1510#B

(See requirements text and test case trace in Appendix A)

Test Configuration:

(Additional detail to be provided as interface is further defined)



Participants and Support Requirements:

Participants: FDF, EOC/FOT, I&T  
EBnet (network manager if needed)

Communications:

Voice:

**TBD**

Data:

EBnet connections at EOC and FDF (Bldg 28)

FDF workstations and EOC elements connected to EOC Support LAN

IP addresses: **TBS**

## Equipment and Software

# FDF Workstation

## RTADS software

## IST software

EOC Operator Terminals  
Data Server  
Real Time Server  
File Server

Planning and Scheduling Sub-system  
User Interface Sub-system  
Telemetry Sub-system

## Test Tools:

TBD

### Test Data:

Description / Characteristics	Source	File/script name & Location
Predicted TDRSS ephemeris Predicted AM-1 ranging data Predicted orbital events Solar / Lunar azimuth and elevation angles Solar Beta angles Predicted Local Sun time Lunar beta angles MODIS/MISR sun/moon FOV events MODIS/MISR planet/star FOV events Predicted sub-satellite points Predicted spacecraft altitude Predicted spacecraft day/night length Solar/Lunar/Planetary ephemeris Solar Array Coordinate coefficient table TDRSS mass and solar pressure coefficients Spacecraft state vectors for DSN Ground Stations X-band interference times Apogee, perigee, altitude file Predicted orbit number and time data set		
16 kbps AM-1 Housekeeping telemetry stream to support real time and non-real time attitude determination tests and TONS monitoring and support tests.		TBS
Maneuver Planning Data  FDF - EOC data flows  FTP transfers	FDF	TBS

Description / Characteristics	Source	File/script name & Location
<p>Orbit adjust burn times and duration</p> <p>Mass and center of mass location estimates</p> <p>Planned orbit maneuver dataset</p> <p>EOS AM-1 post maneuver report</p> <p>FAX transfer</p> <p>Orbit adjust maneuver request</p> <p>EOC - FDF data flow</p> <p>Propulsion telemetry</p>	Derived from housekeeping telemetry data set provided by ETS	
<p>TONS monitoring and evaluation data</p> <p>FDF - EOC flows</p> <p>On board navigation evaluation (provided by TGSS)</p> <p>Evaluation of proposed on-board navigation system algorithms (FAX)</p> <p>TONS initialization parameters (FTP)</p> <p>EOC - FDF flows</p> <p>Non-real time TONS telemetry</p> <p>Real-time TONS telemetry</p>	<p>FDF</p> <p>Derived from housekeeping telemetry data set provided by ETS</p> <p>Derived from</p>	

Description / Characteristics	Source	File/script name & Location
<p>Onboard Navigation Operating Parameter change report (FTP)</p> <p>Onboard Navigation System flight software updates (FAX)</p>	housekeeping telemetry data set provided by ETS	
<p>Sensor Calibration Data FTP transfers</p> <p>Sensor Calibration Trend Report</p> <p>Sensor Calibration Data IRU calibration maneuver plan</p>	FDF	
<p>Attitude Determination Data FDF - EOC flows</p> <p>Attitude predictions (FTP) SCC Attitude Validation Report (FAX)</p> <p>EOC - FDF flow</p> <p>Non real time attitude telemetry</p>	FDF	
<p>Nominal 16 kbps Housekeeping telemetry for real time attitude determination.</p> <p><b>What parameters do we need to vary to see attitude change?</b></p>	ETS	Script Name - ict10_1.script

References:

EOS - AM1 - Flight Dynamics Facility (FDF)/EOSDIS Core Systems (ECS)  
Interface Control Document - Draft April 19, 1996

Test Case Descriptions:

[These are preliminary and will be refined when the ICD is published]

**ICT10.1      Attitude Determination**

Real-time attitude determination:

The ETS will transmit a 16 kbps housekeeping telemetry stream to the EOC. The FDF workstation in the EOC will extract the attitude sensor parameters through the telemetry monitoring tool in the IST. The extracted data will be input to the Real Time Attitude Determination System (RTADS) and the real time attitude display generated. This display will be generated on the FDF workstations and the FOT work stations. The real time attitude display will also be transmitted from RTADS via the EBnet connection to the FDF Operations Area in Building 28. [TBR]

**[NOTE:      RTADS may be implemented as a part of the IST. Negotiating with HITS as of 7/23]**

**[CHALLENGE: IT WOULD BE GOOD IF WE COULD GET SOME DYNAMIC ATTITUDE SENSOR DATA SO WE COULD WATCH THE POINTING VECTORS CHANGE - MAY NOT BE EASY. - RTADS simulator planned by 550]**

Non-real time attitude determination:

Non real-time attitude data files will be created in the Analysis sub-system and transferred to the FDF work-stations via a standing order analysis request from the IST. Refined attitude determination data will be computed and provided to the Data Management System via FTP. This data will be dumped from the DMS and format checked for compliance to the ICD.

Attitude Sensor Calibration Data

The FDF workstation will generate the following products and provide them to the DMS via FTP transfer. The data will be dumped from the DMS and format checked for compliance to the ICD.

Sensor Calibration Trend Report

Sensor Calibration Data  
IRU calibration maneuver plan

## **ICT10.2 Planning and Scheduling Product Transfers**

The FDF workstation will generate the following products and provide them to the DMS via FTP transfer. The data will be dumped from the DMS and format checked for compliance to the ICD.

EOS mission star catalog - [assume this is an infrequently generated item - from **FDOA? - PROBABLY AVAILABLE THOROUGH FDF PRODUCT CENTER**]

Star Density profile  
SSST Star Interference  
ESA Sun/Moon interference  
FSS visibility predict  
TDRSS state vectors  
EOS Brouwer /Lyddane Elements  
TDRSS Brouwer /Lyddane Elements  
OMNI - TDRSS viewing times  
HGA-TDRSS viewing times  
HGA gimbal angles  
Predicted AM-1 ephemeris  
Predicted TDRSS ephemeris  
Predicted AM-1 ranging data  
Predicted orbital events  
Solar / Lunar azimuth and elevation angles  
Solar Beta angles  
Predicted Local Sun time  
Lunar beta angles  
MODIS/MISR sun/moon FOV events  
MODIS/MISR planet/star FOV events  
Predicted sub-satellite points  
Predicted spacecraft altitude  
Predicted spacecraft day/night length  
Solar/Lunar/Planetary ephemeris [**WWW FDF PRODUCT CENTER**]  
Solar Array Coordinate coefficient table  
TDRSS mass and solar pressure coefficients  
Spacecraft state vectors for DSN Ground Stations  
X-band interference times  
Apogee, perigee, altitude file  
Predicted orbit number and time data set

## **ICT10.3 TONS Monitoring and Support**

Real time monitoring

ETS will transmit a 16 kbps housekeeping telemetry stream to the EOC. The TGSS will extract the TONS parameters using the telemetry monitoring tool of the IST [TBR]. TGSS will compute refined TONS initialization parameters and make them available to the DMS. The Command Management Sub-system will format the TONS initialization parameters into table load format. The table load will be dumped and inspected to verify that the parameter values were maintained through the translations.

#### Non-real time monitoring

Non real-time TONS data files will be created in the Analysis sub-system and transferred to the TGSS work-station via a standing order analysis request from the IST.

#### File transfers

The FDF workstation (TGSS) will generate and transfer the following products to the DMS via FTP transfer. The data will be dumped from the DMS and format checked for compliance to the ICD.

##### On-board navigation evaluation

The DMS will transfer the following file to the TGSS via FTP transfer. The data will be dumped from the TGSS and format checked for compliance to the ICD.

##### On-board Navigation Operating Parameter Change Report

#### **ICT10.4      Maneuver Support**

The FDF workstation will generate the following products and provide them to the DMS via FTP transfer. The data will be dumped from the DMS and format checked for compliance to the ICD.

Orbit adjust burn times and duration

Mass and center of mass location estimates

Planned orbit maneuver dataset

Non-real time propulsion telemetry data will be extracted from a stored telemetry data set by the Analysis sub-sytstem and transferred to the FDF workstation via an analysis request from the IST. The data will be dumped from the FDF workstation and format checked for compliance to the ICD.

From the propulsion telemetry data (or by simulation) the FDF workstation will generate the EOS AM-1 Post Maneuver Report and transfer it to the DMS. The data will be dumped from the DMS and format checked for compliance to the ICD.

**ICT10.5 FDF Product Archive at the GSFC DAAC**  
**(TBS)**

### Test Procedures:

#### Test Set up:

Step	Station	Action	Expected Results	Comments
1.	FOT workstation	Login as ground controller Record the system configuration on the execution cover sheet.	Login allowed	
2.	FDF workstation	Login as FDF operator	Login allowed	
3.	FOT (ground controller)	Configure a logical string for telemetry simulation using the ETS LRS as a data source.		
4.	FOT (ground controller)	Open an events page window.  Check ETS - EOC telemetry connection <b>(?? Test message ?? - Unix PING ??)</b>		
5.	ETS operator	Load script <b>ict10_1.script</b> to transmit 16 kbps house-keeping telemetry to the EOC.		
6.	FDF operator	Check the RTADS display connection to the FDQA in building 28  <b>(?? Test message ?? - Unix PING ??)</b>		

### ICT10.1 Attitude Determination

Step	Station	Action	Expected Results	Comments
1.	FOT (ground controller)	Configure the telemetry sub-system to receive and process 16 kbps housekeeping telemetry.	Bring up page ( <b>TBD</b> ) to monitor real time attitude parameters.	
2.	FDF operator	Select the telemetry monitoring tool of the IST and configure it to receive and display attitude telemetry.		
3.	FDF operator	Start RTADS		
4.	ETS operator	Start the LRS processing 16 kbps housekeeping telemetry from script <b>ict10_1.script</b> . at the test conductor's direction.		
5.	FOT ground controller	Verify lock on ETS telemetry, display updates on page ( <b>TBD</b> )		
6.	FDF operator	Verify lock on ETS telemetry, display updates on page ( <b>TBD</b> )		
7.	FDF operator	Bring up the RTADS display and verify real time computations and display updates.	[CHALLENGE: HOW DO WE CREATE DYNAMIC TEST DATA THAT GIVES US A RECOGNIZABLY CORRECT PATTERN TO LOOK FOR ??]	

Step	Station	Action	Expected Results	Comments
8.	FDOA	Verify updates to RTADS display in FDOA [CCL circuit available ??]		

## ICT10.2 Planning and Scheduling Product Transfers

Note: Product generation steps can be completed off line or in a separate session, with transmittal and format checking occurring in this session.

[Is there a file naming convention for these products? - didn't see it in the draft ICD]

[Need to find out what the dependency relations between these products are]

Step	Station	Action	Expected Results	Comments
1.	FDF workstation	Assume the following initial conditions for product generation:  Nominal AM-1 launch insertion parameters (TBD)	time span: 22 Dec 98 00:00:00 24 Dec 98 00:00:00	AM-1 and TDRSS ephemeris files need to be available for this time span.
2.	FDF workstation		Generate predicted AM-1 ephemeris data for the test time frame.	

3.	FDF workstation	Generate predicted TDRSS ephemeris for the test time frame.
4.	FDF workstation	Generate / transfer from FDOA the EOS mission star catalog.
5.	FDF workstation	Generate the star density profile for the test period.
6.	FDF workstation	Generate the SSST star interference product for the test period.
7.	FDF workstation	Generate the ESA sun/moon interference product for the test time period.
8.	FDF workstation	Generate the FSS visibility product for the test time period.
9.	FDF workstation	Generate TDRSS state vectors for the test time period.
10.	FDF workstation	Generate EOS B/L orbital elements for the test time period.
11.	FDF workstation	Generate TDRSS B/L orbital elements for the test time period.
12.	FDF workstation	Generate OMNI - TDRSS viewing times for the test time period.  ** = (Note: Normal time spans are 7 weeks (long range) and 7 days (short range))
13.	FDF workstation	Generate HGA - TDRSS viewing times for the test time period.  **
14.	FDF workstation	Generate HGA gimbal angles for the test time period.

15.	FDF workstation	** Generate predicted AM-1 ranging data for the test time period.  (1 day file only)
16.	FDF workstation	** Generate predicted orbital events for the test time period.
17.	FDF workstation	** Generate solar/lunar az/el angles for the test time period.
18.	FDF workstation	** Generate solar beta angles for the test time period.
19.	FDF workstation	** Generate predicted local sun time for the test time period.
20.	FDF workstation	** Generate Lunar beta angles for the test time period.  (Normal - 7 weeks)
21.	FDF workstation	** Generate MODIS/MISR sun/moon FOV events for the test time period.

22.	FDF workstation	Generate MODIS/MISR planet/star FOV events for the test time period. **	
23.	FDF workstation	Generate predicted sub-satellite points for the test time period. **	
24.	FDF workstation	Generate predicted spacecraft altitude for the test time period. **	
25.	FDF workstation	Generate predicted spacecraft day/night for the test time period. **	
26.	FDF workstation	Generate solar / lunar / planetary ephemeris for the test time period. ?? Maybe provided from FDOA ??	
27	FDF workstation	Generate solar array coordinate coefficient table for the test time period.	
28.	FDF workstation	Generate TDRSS mass and solar pressure coefficients for the test time period.	
29.	FDF workstation	Generate spacecraft - ground station (DSN/GN/WOTS) state vectors for the test time period.	
30.	FDF workstation	Generate X-band interference times for the test time period. **	

31.	FDF workstation	Generate Apogee, perigee, altitude for the test time period.  (Normal - 7 days)	
32.	FDF workstation	Generate predicted orbit number and start times for the test time period.  **	
33.	FDF workstation	FTP the planning and scheduling products to the DMS via ECL procedure SP_XFER.  <b>S SP_XFER</b>	
34.	FOT workstation	<b>[Is this put or get?]</b> Open a Unix window - check the DMS directory that receives planning aids ( <b>TBD</b> )and verify all transfers made - compare file sizes at the DMS and FDF workstations.	All files present and file sizes match.
35.	FOT workstation.	Dump headers and first 10 data records of each product via ECL procedure DUMP_SP.  <b>S DUMP_SP</b>	

**Post Test Analysis:** Verify each product format conforms to the EOC - FDF ICD by visual inspection.

### ICT10.3 TONS Monitoring and Support

Step	Station	Action	Expected Results	Comments
1.	FOT workstation	Verify EOC configured to support simulated AM-1 telemetry from ETS.		
2.	FDF workstation (TGSS)	Bring up the IST telemetry monitoring tool and configure it to extract and display TONS parameters.		
3.	ETS	Transmit 16 kbps housekeeping telemetry to the EOC at the test conductor's direction.	FOT workstation verify lock and receipt of telemetry packets.	
4.	FDF workstation (TGSS)	Verify lock on telemetry and extraction and display of TONS parameters.		
		<b>[Is this all that gets done? Monitoring?]</b>		
5.	ETS	Stop transmission of the 16 kbps housekeeping telemetry at the test conductor's direction.	Verify LOS at the FOT workstation.	
6.	FOT workstation	Create and send to the local archive a telemetry data set from the 16 kbps housekeeping data.		
7.	FOT workstation	Submit an analysis request to extract the TONS parameters from the telemetry data set created in step 6.	Analysis report returned by the analysis subsystem.	
		<b>[Is this supposed to be a standing request from TGSS??]</b>		
8.	FDF workstation (TGSS)	Transfer the TONS analysis report to the TGSS.		

9.	FDF workstation (TGSS)	Generate the on-board navigation evaluation report.  <b>[What are all the required inputs?]</b>
10.	FDF workstation (TGSS)	Generate (provide?) TONS initialization parameters.
11.	FDF workstation (TGSS)	Transfer the onboard navigation evaluation and the TONS initialization parameters to the DMS via ECL procedure TGSS_XFER  <b>S TGSS_XFER</b>
12.	FOT workstation	<b>[Put or get ??]</b> Verify the onboard navigation report and TONS initialization parameters are present in the DMS directory ( <b>TBD</b> )  Check file sizes and time stamps match FDF workstation values
13.	FOT workstation	Dump/print the onboard navigation report and TONS initialization parameters via ECL procedure DUMP_DMS.  <b>S DUMP_DMS</b>
14.	FOT workstation	Generate / provide the on-board navigation operating parameter change report
15.	FOT workstation	Transfer the on-board navigation operating parameter change report to TGSS.

		<b>[Put or get ??]</b>
16.	FDF workstation (TGSS)	Check the TGSS directory ( <b>TBD</b> ) where the on-board navigation operating parameter change report is sent and verify correct file size and time stamp.
17.	FDF workstation (TGSS)	Dump / print the on-board navigation operating parameter change report via ECL procedure DUMP_TGSS  <b>S DUMP_TGSS</b>

**Post Test Analysis:** Verify that the on-board navigation operating parameter change report, on-board navigation evaluation, and TONS initialization parameters conform to ICD format by visual inspection.

#### ICT10.4 Maneuver Support

Step	Station	Action	Expected Results	Comments
1.	FDF workstation	Generate / provide the following products:	<ul style="list-style-type: none"> <li>• Orbit adjust burn times and duration</li> <li>• Mass and center of mass location estimates</li> <li>• Planned orbit maneuver dataset</li> </ul>	
2.	FDF workstation	Transfer the products generated in Step 1 to the DMS ( <b>using the Data Mover Tool</b> )		

		<b>in the IST ??)</b>	
3.	FOT workstation	Print / dump the transferred products from the DMS and retain for post test analysis via ECL procedure MVR_DUMP	
4.	FDF workstation.	<p><b>S MVR_DUMP</b></p> <p>Submit an analysis request via the IST for propulsion telemetry</p> <p>start time - TBD stop time - TBD Subsystem - PROP Destination - &lt;FDF w/s directory&gt;</p>	<p>Analysis sub-system returns completed report to FDF workstation in specified directory.</p>
5.	FDF workstation	Dump / print the analysis report and retain for post-test analysis.	
6.	FDF workstation	Generate an EOS AM-1 Post Maneuver Report	
7.	FDF workstation	Transfer the EOS AM-1 Post Maneuver Report to the DMS ( <b>via the Data Mover Tool in the IST ??)</b>	
8.	FOT workstation	Dump / print the EOS AM-1 Post Maneuver Report and retain for post test analysis.	

**Post - Test Analysis:** Verify the maneuver support data products conform to the ECS - FDF ICD by visual inspection.

**ICT10.5 FDF - GSFC DAAC Product Archiving**

Step	Station	Action	Expected Results	Comments
1.				

Test termination:

Step	Station	Action	Expected Results	Comments
1.				

## Appendix A.

### Test Package Requirements Summary

Requirement	Description	Test Case(s)
EOC-5185#B	The EOC shall provide the FDF with a subset of the telemetry stream which includes the following data: a. Attitude sensor data b. Navigation telemetry data c. Spacecraft maneuver telemetry data	ICT10.1 ICT10.3 ICT10.4
EOSD-1502#B	ECS elements shall use EBnet for data communications for the following types of data:  g. Data exchange with the FDF	ICT10.2
EOSD-1505#B	ECS elements shall receive EOS spacecraft predicted orbit data and post pass ephemeris determination from the FDF.	ICT10.2
EOSD-1510#B	ECS elements shall provide the FDF with subsets of spacecraft housekeeping data related to the on-board attitude and orbit systems.	ICT10.1